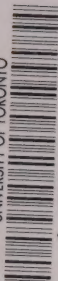


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AN OVERVIEW
OF
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IN ONTARIO

A Report to the Human Resources Committee
Ontario Council of Health

by

D. W. Lewis

RESEARCH REPORT

*issued by the
Dental Health Care
Services Research Unit*

THE FACULTY OF DENTISTRY



UNIVERSITY OF TORONTO



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Prepared for the
Dental Health Care Services and Epidemiology
Research Unit
Faculty of Dentistry University of Toronto
February, 1974

This project was supported in part by
demonstration model grant DM 148 of
the Ontario Ministry of Health

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Report to the Human Resources
Committee, Ontario Council of Health

D.W. Lewis *, February 21, 1974.

AN OVERVIEW OF FUTURE DENTAL MANPOWER REQUIREMENTS IN ONTARIO

I want to thank you for the opportunity of presenting formally some of my thoughts on dental manpower using, in part, two studies Mrs. B. Isabel Brown and I have recently completed. Following this paper I look forward to your questions.

I first wish to refer to the implications I see in my title. (An Overview of Future Dental Manpower Requirements in Ontario.) "Overview" indicates that I will only touch upon some of the highlights of the very complex question of dental manpower. "Future ... Requirements" implies the need to foresee - - to project for years ahead the need for sufficient numbers of properly distributed and trained dental personnel who are matched to the dental care needs and anticipated changing demands for care of the public. The need for health manpower planners to make concrete decisions in the face of the many unknown factors here and especially the interaction of combinations of these unknowns factors is frightening to contemplate. It is essential to plan but surely not without some reasonably clear idea of the shape and extent of future publicly-funded dental care schemes. Manpower planning divorced from program planning is an absurd notion. However, even if this marriage is realized, uncertainties will prevail, just as in real-life marriage, since good information on the most efficient mix of personnel and on how many of anyone type of personnel are required, is not available. "Dental manpower" in the title should include the whole host of personnel directly and indirectly providing dental care. My

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remarks however mainly refer to dentists and to a lesser degree, expanded-function dental auxiliaries because our studies involved these two categories of workers.

It is a rather short title but I can read a lot into it.

As a general introductory framework for what health manpower planners must do, the provision of more dental health care services involves the following three alternatives: ¹

1. Allocation of more resources to dentistry by removing resources from elsewhere. Essentially this would mean increased production of dental personnel. Today nearly everyone realizes that this as the sole solution, is not satisfactory.
2. Re-organization of existing resources for the provision of dental care to maximize efficiency, unless of course efficiency already has been optimized and the system is operating at maximum productive capacity. The idea here is to increase the capacity of existing resources, perhaps by more effective utilization of existing auxiliaries through expanded duties. Other possibilities also arise. Are groups more productive than the additive results of a similar number of solo practitioners? Are clinics the answer? What is the optimum number of dental chairs and auxiliary staff to produce the most efficient office design? Generally with a scarcity of resources this would be the best alternative. The objective would be to increase the quantity of dental health care services provided without sacrificing quality.
3. A combination of 1. and 2. arises since the capacity of even a re-organized system of providing care can reach a saturation point. Re-organization for greater efficiency alone may not be sufficient in dentistry because of existing massive dental health problems. New dental personnel may also be required.



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PROBLEMS IN DENTAL STUDIES

To fully appreciate the difficulties in dental manpower studies it is essential to outline some of the problems involved. These are in addition to the basic problem for the manpower planner which is the need to be aware of the political decision on the nature of denticare we shall have in this province - - denticare for what groups, what services and how they are to be provided, and when. The myth of planning without politics is indeed a myth, but hopefully the eventual political decision will be tempered by scientific and social rationale yet keeping in mind the traditional character of the present dental delivery system.

A short commentary on some of the problems follows:

1. Adequacy - - adequacy immediately infers value judgement and uncertainty.

In addition to the difficult question of what adequate dental health is, we are faced with defining adequate levels of supply of dental personnel. I have expressed my philosophy on this previously as: ... "we must substitute the real need for prevention and treatment in place of fluctuating demand as a principal measure for the adequacy of manpower" , and elsewhere, "good dental health of virtually all persons rather than demand for care should be the criterion of adequacy of current supply of dental services and the determinant of future dental program service arrangements" 2, 3.

2. Utilization - - Previously the need for effective utilization of all levels of dental personnel was referred to. Here however I am thinking about the percentage of the projected numbers of persons at various ages who will use each year a denticare program. Even in the absence of any such plan, utilization of dentists' services is increasing. What will utilization be when this existing trend is combined with the effects of a subsidized denticare plan on various age groups? And will there be regional variations in utilization? Many assumptions must be made here.

3. Dental care service needs -- The actual specific treatment requirements of children can be estimated from dental public health surveys and research studies where the services provided to children are recorded. 4, 5, 6 But at best these are crude estimates while for the rest of the population the data are even weaker. The treatment time required to service these needs must in some cases be determined by multiplying the estimated needs by further estimates of the dentist's chair-time required to treat each specific disease category. There are obvious dangers here.

4. Content and frequency of diagnostic and preventive services - - this is a very critical area which is generally ignored in spite of the fact that it can influence tremendously dental manpower requirements and costs. For the majority of children some of the standard procedures may not be needed as often as currently believed. For example, can we justify two annual examinations for all children? How often are radiographs needed? What about two annual topical fluoride applications and any use of topical fluoride for most children fully-exposed to water fluoridation? To some, such questions are tantamount to treason and to others, highly responsible. I personally am not convinced that the scientific basis for everything we do and how often we do it in dentistry is abundantly evident. Indeed there are some hints in the recent literature that some services may be done less often without long term harm to dental health.⁷ Dental manpower planners must be concerned about this because the elimination of "non-essential" procedures taking just fifteen minutes of treatment time per child annually for children 3 to 13 years of age in Ontario would be equivalent to an annual saving of the total hours of service provided by nearly two hundred full-time dentists; in other words, more than the annual output of the two dental schools in this province. I should stress that the evidence concerning this issue at the moment is not definitive and that for a small proportion of children a lowered frequency of these services might be bad..

The research problem we shortly intend to pursue is to find out whether or not certain services are needed and if so, how often they are required. The means of identification of children who have more frequent needs is also essential.

5. Active dentists - - the existing supply of licensed dentists consists of those who are fully or partly engaged in dental treatment of the public as well as dentists who are retired or in research and administrative positions so that they provide no direct service. Estimates of non-practising dentists in Ontario range from 10% to 20%. My main point is that although these provincial average percentages may be correct, the situation in each region of the province is really unknown because the appropriate data (as well as data on number of auxiliaries and office and equipment arrangements) are not available on the individual practitioner.

6. Capacity - - it cannot be assumed that all active dentists are operating at full capacity. In Ontario in 1968 nearly 10% of the dentists responding to a survey claimed they were not busy enough and could each accommodate an average of 426 more patients. While this situation reflects oversupply of dentist services in relation to current demand, it does further complicate manpower planning since the exact location of these dentists is unknown.

Many more of the difficulties which plague the dental health manpower researcher could be cited. But perhaps the ones just mentioned underscore sufficiently my concern.

DENTAL MANPOWER SUPPLY IN ONTARIO

Before exploring the future for dental manpower it is salutary to examine where we are now and have been. A number of tables on dentist and dental hygiene supply from 1961 to 1971 from the publication Canada Health Manpower Inventory 1972⁸ have been appended to this report (Tables 1 to 5). Also see Figure 1. Generally these data show that the supply of dentists and dental hygienists in Ontario has kept pace with, and often exceeded population growth. This however does not mean that the supply is adequate or that the distribution is equitable.

But things overall are not getting worse. Indeed I have seen a draft report prepared within the Ministry of Health which suggested that if trends over the past few years continue (including immigration of 61 dentists annually), the Ontario dentist-population ratio will improve from 1/2242 at the end of 1973 to 1/2012 by 1980, and to 1/1941 by 1985. If accurate, these are optimistic (and welcome) results compared to other projections made just a few years ago. 9, 10 We used these projections in the recent Ontario Dental Association Manpower Study.

Very little is known about the numbers and distribution of other dental auxiliary workers, partly because they are not subjected to the audit permitted by licensing. Two surveys done in Ontario in 1966 and 1968 indicate that dentists employ an average of about 1:1 full-time and 0.4 part-time auxiliaries (excluding dental hygienists).^{11, 12} Surprisingly, unless the relevant data represent semi-retired dentists about 15% of the respondents in the earlier survey and 26% in the later one, did not even employ a full-time chairside dental assistant. However a more recent survey (1971) put this figure at just 5%.¹³

Two current Canadian studies - - sponsored by National Health and Welfare, Ottawa¹⁴ and the other by the Ontario Dental Association - - have estimated future dental manpower requirements under publicly funded denticare plans. Although the federal study has received some publicity, I will describe its methods, results and implications only briefly as the other study is, I believe, of greater immediate relevance to the Ontario scene. And besides, unlike the federal study, the Ontario Dental Association one has not yet been released which gives it a certain esoteric and mystical quality.

The federal project arose because unlike several other health disciplines, there was no acceptable Canadian standard, ideal ratio with which to compare existing and projected dentist supply. We did discover in our search that internationally such ratios are not available either.

Briefly the problem given us was to provide estimates of target dental manpower/population ratios for Canada under four special conditions. These conditions were: the existence or non-existence of publicly financed dental prepayment for children combined with the use or not of dental therapists (New Zealand dental nurses).

The calculations were done by a method using a mixture of three main components: demand (utilization) for dental services by each of four age and four care groups; chair hour needs for each age and care group; chairtime provided by dentists and therapists.

The utilization rate of children for the calculation of these idealized ratios was defined for us as at least equal to the highest utilization reported (i.e. 70%) for any age group in any province in the national survey, Dental Health Care Received in 1967 ¹⁵. Thus high utilization but equal to that experienced by some groups already in Canada, was pre-determined even though it was realized that this would not be reached in all provinces at the same rate. Large problems arose in identifying representative patient dental chair hour needs. The published data we necessarily had to use were of limited scope and often involved special regional studies which may not be nationally representative. Because of our concerns about the basic data, we used combinations of two sets of utilization rates with two sets of treatment need hour figures in order to give high and low estimates of ratios with the hope that the "truth" for Canada would lie somewhere in this range.

Against the background of the 1971 ratio of 1 dentist for every 2814 persons in Canada, the study indicated that:

A. Dentist/population ratios of 1:1222 to 1:1424 are required to achieve desirable levels of utilization of dental care services in Canada in the future;

B. Anticipated increases in annual utilization and frequency of care resulting from a publicly financed dental prepayment program for the 0-18 year age group, will require ratios of 1:1100 to 1:1291;

C. Target ratios of 1:1822 to 1:2042 for dentists (higher than A or B) are possible under the same utilization as in A when maximum use (with the 0-18 year age group) is made in private dentist practice of dental therapists who must be available in the ratio of 1:3599 and 1:5432 (total population), respectively, to counterbalance the decreased need for dentists;

D. Utilization of therapists in '1500-hour' school clinics to work on the age group (0-18) in a publicly financed prepayment scheme having a 90% patient utilization experience, requires ratios of therapists to population of from 1:2681 to 1:3551 coupled with dentist supply ratios of 1:1681 and 1:1912, respectively; note that here patient utilization is higher than C and only slightly above B.

These dentist/population ratios are not too dissimilar from those already found in a number of countries (Figure 2). Under the conditions and assumptions used in these national calculations it appears that with current levels of dentist team productivity, Canada needs about 2.0 to 2.6 times more dentists whether dentifcare for children is introduced or not. I should hasten to add that these estimates would undergo substantial modification when Ontario alone is considered since dental treatment needs here may be lower than those used in the federal study and our present and projected future relative supply of dentists is better.

With the introduction either in private practice or school clinics of dental therapists who are heavily involved in children's dental work, the required increases in dentist supply in Canada are noticeably less - - about 50% more dentists being required. For the duties common to the dental therapist and dentist, each with an assistant, productivity was assumed to be equal. Therefore, with similar patient utilization rates, the total number of persons

(dentists or therapists plus dentists) required to work directly in the oral cavity is similar whether therapists are used or not except for the slight "cost" in extra dentists required to supervise the therapists.

Well, as a first effort at determining target dental manpower/population ratios (Lee and Jones ¹⁶ had done this for the U.S.A. in 1933 but since then little else with one exception ¹⁷ seems to have been done), this federal study does provide some insight into Canada's needs, and particularly a methodology which with some refinement and more satisfactory basic data, will prove useful in the future. The study commissioned by the Ontario Dental Association as background research for its proposal for a dental care plan for children is very relevant, I believe, to this committee's responsibilities. I will describe it now.

The Ontario Dental Association "study" is actually a series of several studies. In the first study ¹⁸ the dental service needs of children were determined for children 3 to 13 years of age over a five-year period, starting with children 3 to 5 years in 1974-75 and by successively adding two age groups each year through to 1978-79. These service needs were converted to chair-time needs and then combined with Ministry of Treasury and Economics age population projections and the O.D.A. children's plan utilization rates (50% to 70% for 3, 4, and 5 year-olds and 80% for older children) to give the estimated chair hours of treatment needed by plan participants each year in Ontario and in each of its 53 counties and districts. These data were subsequently used in a study to be mentioned shortly.

Independently, another study estimating the number of chairside hours of dental service available in each county and district of Ontario for the same period 1974-79 was completed ¹⁹. Several features of this study are noteworthy. First, in order not to overstate the supply of services by using the projected numbers of licensed dentists, these numbers were reduced by nearly 20% to reflect

truly active full-time dentist equivalents. Since the distribution of dentists giving primary care, especially to children, was important all specialists other than paedodontists were among the excluded 20%. The projected supply of services (available chairside hours) over the five-year period was done in two sections: for the dentists as described above; and for these dentists plus expanded function auxiliaries (E.F.A.) starting in year two of the plan (1975-76). These E.F.A. were considered to be dental hygienists working with dentists who could among other duties, place and then trim filling materials in cavity preparations cut by the dentist. This is described as the P.E.I. hygienist in Canada and experimentation with this auxiliary is currently underway in Ontario. It was assumed that this auxiliary would increase the productivity of the team to which she was added by 50% (i.e. 750 chairside hours). The number of auxiliaries available was assumed to be 10% of all full-time dentist equivalents in 1975-76, rising in 5% steps to 25% in 1978-79. This means about 314 E.F.A. in the first year and a total of 487, 672 and 864 in the second, third and fourth years, respectively. These anticipated new auxiliaries as well as newly registered dentists were allocated to the 53 counties and districts in proportion to the existing number of full-time dentist equivalents located in them.

The resultant estimates of available dental chairside hours are about 4.5 million in 1974-75 and 5.2 or 5.8 million in 1978-79 depending on whether dentists alone or dentists plus E.F.A. are considered. These anticipated available hours have no useful meaning unless related to the hours of treatment needed by the public.

The third study was necessary then to assess quantitatively whether the projected supply of dental services (chairside hours) in each of the 53 counties and districts of the province was adequate to meet the anticipated service needs of those demanding care in the first five years of a provincial children's dental

care plan as proposed by the Ontario Dental Association and to meet the needs of the remainder of the population.²⁰

Two measures of adequacy of supply of dental service relative to children's service needs were developed. Because the total anticipated supply of services cannot, of course, be devoted entirely to children, the first measure of adequacy of supply proposed that only that fraction of the total available supply of services in each county proportional to the relative size of the covered age group (plus those 0 to 2 years) be allocated for the children's program. The amount of available dental services (chairside hours) determined by this proportional allocation method was then compared with the dental chair hour needs of the utilizing children in each county for each of the five years to identify possible excesses or deficiencies in supply. This method is conservative in approach since dentists presently allocate proportionately more service time to children than their relative population size warrants. It does nevertheless permit identification of possible trouble spots (counties) and quantification of the extent of excess or deficiency in dental services supply.

The second measure of adequacy used was simpler and is particularly useful in areas with few dentists. It was expressed as the percentage of available chairside hours (with and without E.F.A.) needed by the utilizing children in each county for each of the five years. Obviously, counties which must devote a disproportionately high amount of their total available services to the children's plan can be identified by this method.

Even though one of these measures was a fairly strict, conservative indicator, it was found that in the province as a whole sufficient dental services with the addition of expanded function auxiliaries working with dentists and in numbers suggested earlier in this report, would be available throughout the initial five years studied. Because these new auxiliaries and future newly

licensed dentists were assigned to the various counties strictly in proportion to the county distribution of dentists, current imbalances in supply of dentists among counties were perpetuated. Consequently the analysis at the county level demonstrated a substantial number of counties where deficiencies in supply of dental services would be apparent, under a proportional allocation scheme, in a universal children's plan since dentists in these areas must also service the remaining population. This situation however may be easily remedied by an organized incentive program to encourage the new expanded function auxiliaries to go to those counties identified in this analysis as being potentially deficient in supply of services. For example, one solution is to allocate one-half of the expanded function auxiliaries for York County to potentially deficient regions to work on children with the dentists already there. This alone would eliminate all presumed county deficiencies and still leave York County well supplied with services. Thus adequacy of supply and equitable distribution can be realized.

The identification of sites within counties which require salaried personnel in mobile clinics because they are far from centres having (or likely to have) private practitioners requires separate investigation. These mobile clinics would also tend to minimize some of the deficiencies identified above since presumably the salaried dentists would be hired from areas well-supplied with dentists to go to deficient areas.

In summary, this study demonstrated first, that without a new dental school in Ontario, auxiliaries of the type and numbers described earlier must be trained. Secondly, the allocation of some of these auxiliaries (and probably dentists) by an incentive scheme to work with dentists in identified areas where deficiencies are anticipated is required. And thirdly, within some regions further study would reveal areas where mobile clinics might be assigned because private dental prac-

tioners are not (and probably will not be) located there. If these three things are done I am optimistic that the supply of dental manpower services in Ontario to meet the anticipated needs of both a provincial children's dental care plan and those of the remainder of the public demanding care (even at greater levels than at present) will be adequate and reasonably well distributed geographically.

Training programs to produce annually about 300 of these new auxiliaries (who would incidentally devote only part of their time to children), licensing modifications which may be necessary and the eventual distribution incentive programs must be planned now in a co-ordinated way if chaos is to be avoided in the next few years.

Number of Licensed Dental Hygienists,
by Province of Licensure,
Canada, 1967-1971.

TABLE 1

	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>
Newfoundland	0	2	6	5	8
Prince Edward Island	2	3	7	8	8
Nova Scotia	31	36*	42	56	65
New Brunswick	3	6	6	6	4
Quebec	8	12	12	13	11
Ontario	297	317	335	377	423
Manitoba	24	34	46	46	69
Saskatchewan	14	20	23	30	29
Alberta	60	54	61	75	78
British Columbia	37	60	79	130	154
CANADA	476	544	617	746	849

*Estimate

Source: Bureau of Dental Statistics, Canadian Dental Association, March 1972.

TABLE 2

Ratio of Licensed Dental Hygienists to Population,
by Province of Licensure,
Canada, 1967-1971.

	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>
Newfoundland	-	1:253,000	1:85,667	1:103,400	1:65,250
Prince Edward Island	1:54,500	1:36,667	1:15,857	1:13,750	1:14,000
Nova Scotia	1:24,516	1:21,306*	1:18,452	1:13,964	1:12,138
New Brunswick	1:206,667	1:104,167	1:104,667	1:104,500	1:158,750
Quebec	1:733,000	1:494,000	1:498,750	1:462,538	1:548,000
Ontario	1:23,997	1:22,909	1:22,045	1:20,029	1:18,210
Manitoba	1:40,125	1:28,559	1:21,283	1:21,370	1:14,319
Saskatchewan	1:68,357	1:48,000	1:41,652	1:31,367	1:31,931
Alberta	1:24,833	1:28,222	1:25,557	1:21,267	1:20,872
British Columbia	1:52,568	1:33,383	1:26,076	1:16,369	1:14,188
CANADA	1:42,811	1:38,053	1:34,037	1:28,548	1:25,405

*Estimate

Source: Health Manpower Planning Division,
Department of National Health & Welfare, June 1972.

TABLE 3

Number of Licensed Dentists,
by Province of Licensure,
Canada, 1961-1971.

	<u>1961</u>	<u>1962</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>
Newfoundland	43	44	47	43	43	51	51	54	59	62	61
Prince Edward Island	29	31	32	31	31	30	30	29	27	29	31
Nova Scotia	190	185	189	230	230	236	243	239	244	231	238
New Brunswick	124	123	121	120	133	131	135	139	130	125	137
Quebec	1,417	1,434	1,446	1,469	1,516	1,549	1,582	1,623	1,679	1,709	1,754
Ontario	2,522	2,552	2,599	2,623	2,687	2,732	2,810	2,929	3,013	3,182	3,241
Manitoba	283	281	289	287	288	295	293	293	305	306	315
Saskatchewan	193	195	187	195	207	220	228	228	224	226	227
Alberta	434	456	467	484	501	503	535	541	571	577	616
British Columbia	671	698	726	736	760	785	806	857	904	966	1,044
CANADA	5,906	5,999	6,103	6,218	6,396	6,532	6,713	6,932	7,156	7,413	7,664

Source: Bureau of Dental Statistics, Canadian Dental Association, March 1972

TABLE 4

Ratio of Licensed Dentists to Population,
by Province of Licensure,
Canada, 1961-1971.

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
Newfoundland	1:10,651	1:10,636	1:10,128	1:11,233	1:11,349	1:9,667	1:9,784	1:9,370	1:8,712	1:8,339	1:8,557
Prince Edward Island	1:3,621	1:3,452	1:3,375	1:3,516	1:3,516	1:3,633	1:3,633	1:3,973	1:4,111	1:3,793	1:3,613
Nova Scotia	1:3,879	1:4,032	1:3,974	1:3,283	1:3,287	1:3,203	1:3,128	1:3,209	1:3,176	1:3,385	1:3,315
New Brunswick	1:4,823	1:4,919	1:5,033	1:5,092	1:4,624	1:4,710	1:4,593	1:4,496	1:4,831	1:5,016	1:4,635
Quebec	1:3,711	1:3,745	1:3,790	1:3,801	1:3,750	1:3,732	1:3,707	1:3,652	1:3,565	1:3,518	1:3,437
Ontario	1:2,473	1:2,489	1:2,494	1:2,528	1:2,526	1:2,548	1:2,536	1:2,479	1:2,451	1:2,373	1:2,377
Manitoba	1:3,258	1:3,331	1:3,284	1:3,341	1:3,351	1:3,264	1:3,287	1:3,314	1:3,210	1:3,212	1:3,177
Saskatchewan	1:4,793	1:4,769	1:4,989	1:4,831	1:4,589	1:4,341	1:4,197	1:4,211	1:4,277	1:4,164	1:4,079
Alberta	1:3,069	1:3,002	1:3,004	1:2,952	1:2,894	1:2,909	1:2,785	1:2,817	1:2,730	1:2,764	1:2,643
British Columbia	1:2,428	1:2,378	1:2,340	1:2,371	1:2,364	1:2,387	1:2,413	1:2,337	1:2,279	1:2,203	1:2,093
CANADA	1:3,088	1:3,098	1:3,102	1:3,102	1:3,071	1:3,064	1:3,036	1:2,986	1:2,935	1:2,873	1:2,814

Source: Health Manpower Planning Division,
Department of National Health and Welfare, June 1972.

TABLE 5

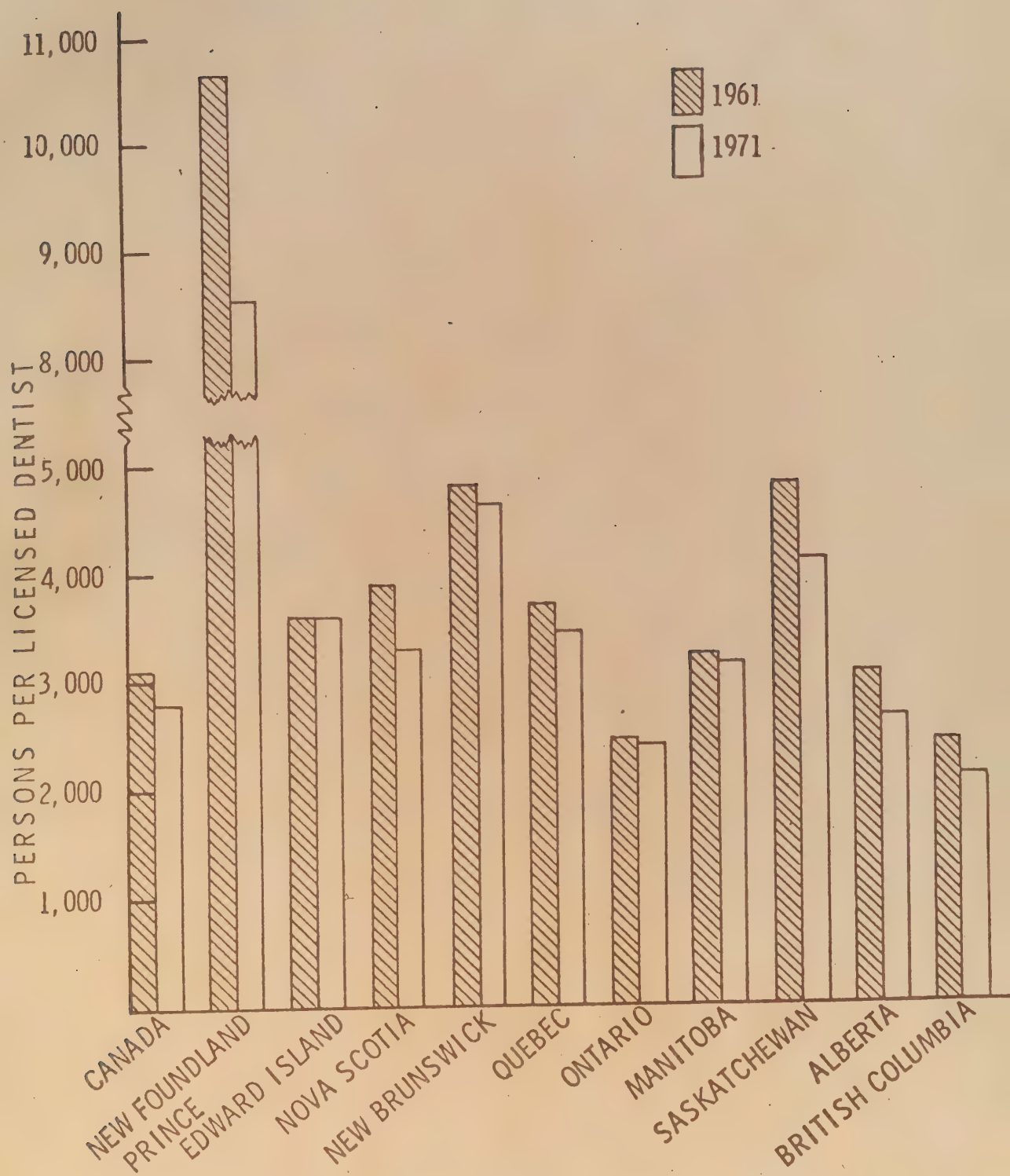
Ratio of Licensed Dental Hygienists to Licensed Dentists,
by Province of Licensure,
Canada, 1967-1971.

	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>
Newfoundland	-	1:27	1:10	1:12	1:8
Prince Edward Island	1:15	1:10	1:4	1:4	1:4
Nova Scotia	1:8	1:7*	1:6	1:4	1:4
New Brunswick	1:45	1:23	1:22	1:21	1:34
Quebec	1:198	1:135	1:140	1:131	1:159
Ontario	1:9	1:9	1:9	1:8	1:8
Manitoba	1:12	1:9	1:7	1:7	1:5
Saskatchewan	1:16	1:11	1:10	1:8	1:8
Alberta	1:9	1:10	1:9	1:8	1:8
British Columbia	1:22	1:14	1:11	1:7	1:7
CANADA	1:14	1:13	1:12	1:10	1:9

*Estimate

Source: Bureau of Dental Statistics, Canadian Dental Association, March 1972.

FIGURE 1



PERSONS PER DENTIST

FIGURE 100

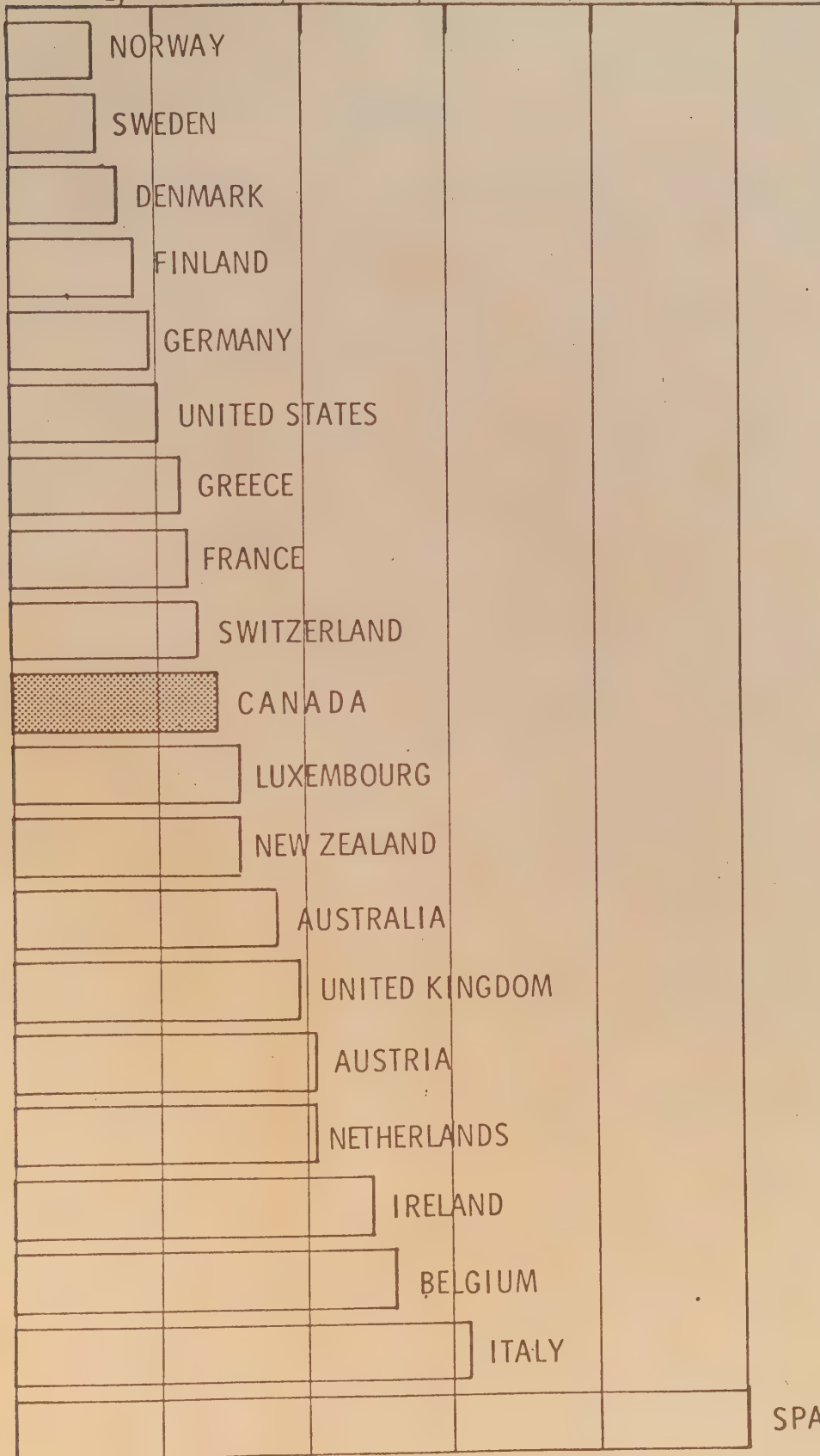
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